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Thingspeak Cloud Based Smart Irrigation System

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Abstract – *Now a days, as the climatic conditions is being changed, most of the farmers are adopting different irrigation systems for cultivation of crops. In India this move towards the irrigation creates significant scope for automation in the field of agriculture popularly termed as the "Smart Irrigation System". The aim of this system is to optimise the cultivation by maintaining desired level of moisture for a particular crop. This system is designed in such way that, the problem of over irrigation and under irrigation can be avoided which prevents the crop from damages.. The complete automation of this system is ensured by embedding it with the Cloud to enable the farmers to monitor the system from their home itself (or from every part of the world).*

Keywords: ***Big data, Soil Moisture sensor, cloud computing Thingspeak, Arduino etc.***

I- INTRODUCTION

In the beginning of 21st Century, the major sectors of economy were revamped with automation. Most of the Industries have implemented the concept of Industry 4.0 for it's growth and optimization. The developing country like India, where agriculture is one of the major sector which contributes about 18% in GVA of our Nation, it is essential to improve the yield from agriculture. However, the agriculture yield is greatly depend on the irrigation facilities (i.e. water). Therefore, for effective utilization of water to avoid water scarcity for the cultivation of crops, the irrigation system must be accomplished with automation termed as "Smart Irrigation System". Now a days in India, Farmers are using about 36% of Automation in the area of Irrigation. The major things that help to optimise the cultivation, that are minerals content and water content (i.e. moisture content) in soil. The smart irrigation system uses IoT which includes mainly cloud computing & data collection with data analytics. This system performs following task;

1. Supply adequate amount of water to soil.
2. Maintain the desired soil moisture level between its preferable range.
3. Collect the data & plot the graph, which is used for data analysis.

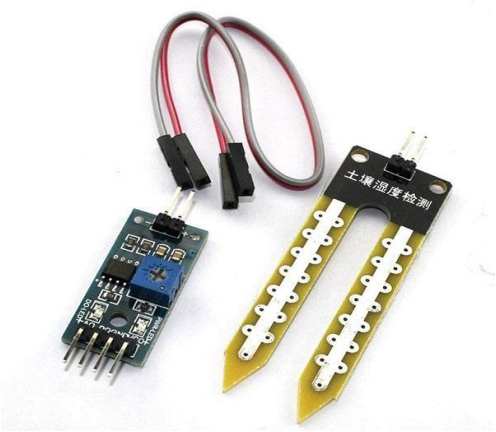
II- HARDWARE SYSTEM

The main system consists of soil sensor module, ESP-8266, GSM GPRS SIM900A, Arduino Uno, Relay, and Pump.

It is used for the detecting the moisture content in soil. The capacitance based soil moisture sensor is used in this system.

The Specifications are mentioned below.

- Working Temperature - -40^{O}C to 60^{O}C
- Operating Voltage – 5V DC
- Operating current :- 40Ma



. Fig. 1 Soil Moisture sensor

2.3 Arduino Uno

It is an open source of microcontroller in which program is embedded for its satisfactory operations. The program made via Arduino IDE software. It performs logic in loop manner. The power supply can be given to Arduino through DC adapter to ascertain a 5V DC supply.

- Operating voltage -5V
- Digital pins 14 (0-13)
- Analog pins- 6 (A0 – A5)
- Microcontroller- ATMega328P

Fig.2 Arduino Uno

Wi-Fi Module

ESP-8266 wifi module is used for wifi connectivity which allows the system to send the data using internet.

- Operating voltage- 3.3V DC
- Working Temperature - -40^{O}C to 125^{O}C
- Flash memory size- 512 KB
- Pins used – VCC, Ground, TX, RX, & Reset pins
- Program used via Arduino IDE or AT- Commands

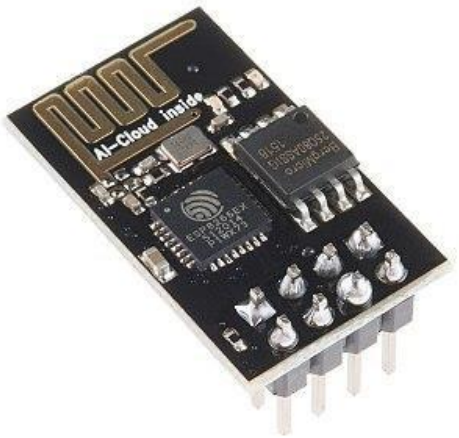


Fig.3 ESP8266

Relay module

Relay is the type of switch which is operated Electro mechanically or Electronically. There is an (NO) Normally open port which is normally in open position. When 5V DC voltage supply is given to relay switch, the coil inside the relay gets magnetized and the relay will get tripped off, which means that the circuit is closed. This condition can be sensed by observing green light which indicates it is in ON condition.

- Operating voltage- 5V DC
- Output parameters – 10A 250V AC
- Input control signal current – 1.5 - 1.9 mA

Fig.3 Single channel relay

GSM Module

GSM module is the circuit which allows the communication between the mobile device and the GPRS. It sends the information about pump condition that is ON/OFF condition via messages.

- Frequency bands – SIM900A
- Single supply voltage – 3.5V to 4.5V
- Communication via AT commands
- Single SIM card
- Operating temperature- -30^{O}C to 80^{O}C

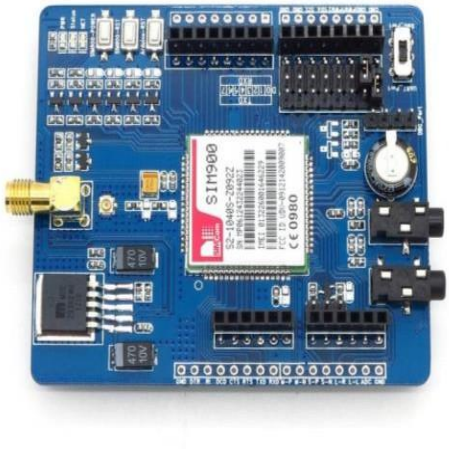


Fig.4 GSM Module

III - PROPOSED ELECTRONIC CIRCUIT & LOGIC

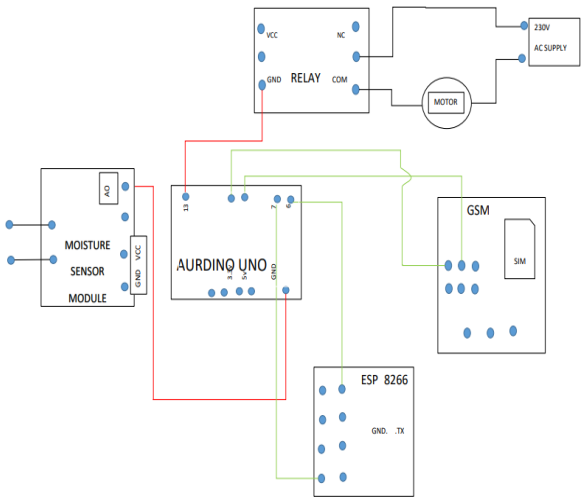


Fig.5 Proposed Circuit

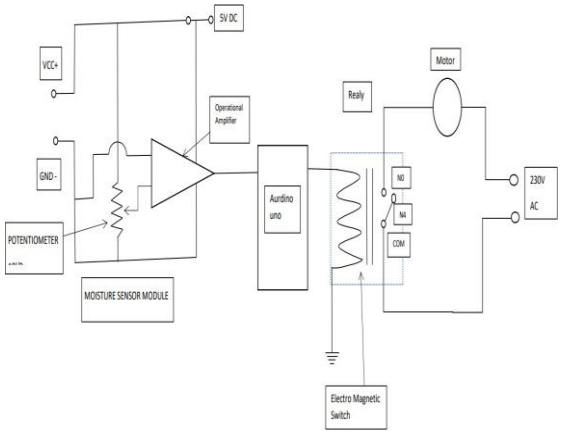


Fig. 6 Proposed Electronic Logic

IV- PROPOSED SYSTEM

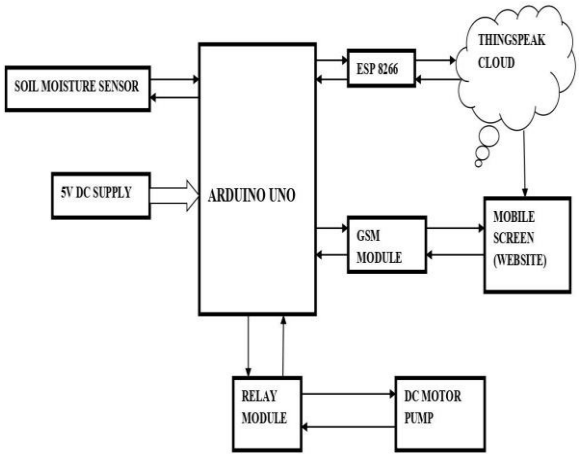


Fig.5 Block Diagram of Proposed system

The proposed system can be divided in to the following sections;

- Input section
- Output section
- IoT sections

The Input section consists of soil moisture sensor module and power supply unit. Similarly the Output sections consist of the Relay module and DC motor pump. Apart from this, the IoT section consists of the Thingspeak cloud server, ESP8266 module & GSM module.

The smart irrigation system is designed for the specific crop so that the value of the required soil moisture can be

varried as per the requirements of different crops. In this, the experiments are performed on Tomato plant, for which about 60% of soil moisture is being maintained. This value of moisture is written in the program code which is to be run in the Arduino. Below & above this moisture value, the problem of under irrigation and over irrigation is occurred.

The sensor probe detects the soil moistureb and sends the information to the Arduino in the form of analog signals. The arduino processes the input given by the moisture sensor and checks the condition which can satisfy the program conditions. If the moisture level is below 60%, then pump turned ON. As soon as the moisture level reaches the value 60%, the pump automatically turned OFF. The information collected from the sensor module is then send to the Thinngspeak server via ESP8266 Wi-Fi module and with the help of the historical data the graph can be plotted between moisture level with respect to date/time. In addition to this, the GSM module of smart irrigation system the sends the Alert messages to the mobile when soil moisture level is falls below 60%.

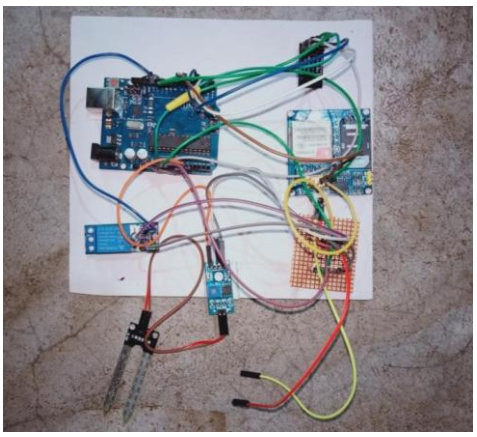


Fig.7 Proposed Electronic Circuit

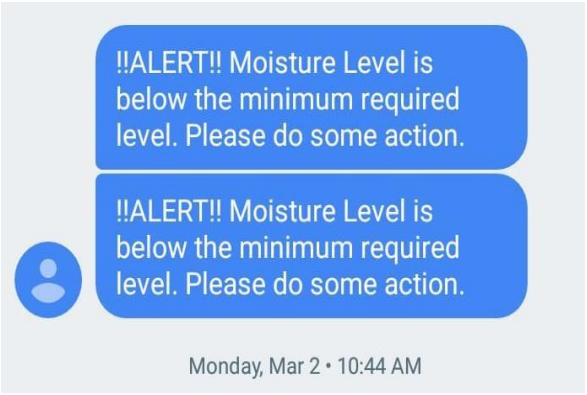


Fig.8 Snapshots of GSM alert

Fig.9 Experimental Setup

V- DATA ANALYSIS

We have successfully performed experiment on tomato plants. According to Indian Agriculture of Research Institute (IARI), the level of soil moisture required for the tomato plant is about 60%, at which it can grow at optimum rate. For the analysis of data we have prepared plant experimental setup as shown in fig. 10. When the system turned ON by using AC adapter, the soil moisture sensor dipped in the soil which detects the initial condition of soil. As the soil moisture falls below the 60% of moisture level the pump turned ON & the same will be turned OFF as the mosture level reaches above 60% & vice versa. We have also recorded the data of the thingspeak as shown in fig.4. The data computation and formulation taken place as below.

For Moisture in percentage:

= 100- [(Analog value /1023)×100]

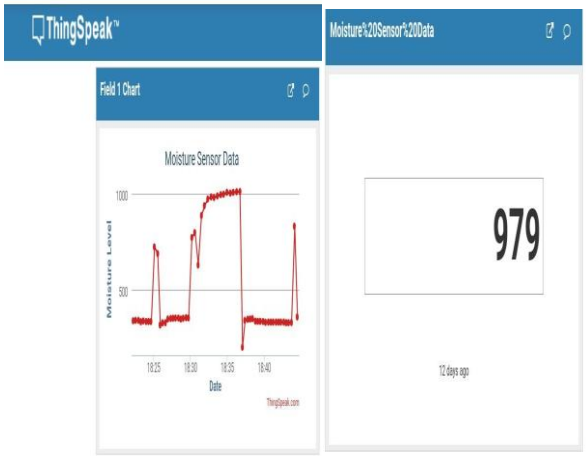


Fig 10. Experiment Recorded Data

VI - CONCLUSION

We have successfully developed the fully automation based irrigation system, which works on the principle of detecting the moisture content of soil. This system proves that, it can be operated without any manual interventions. This system is useful for the farmers of all categories (i.e. small, medium & large farmers) as they can monitor it from their home itself (or from every part of the world). This system is also helpful to save the water which may be wasted due to over irrigation. This system is cost effective, hence can be made available at reasonable price. Therefore, the proper implementation of the smart irrigation system would results in improved yield of cultivation of crops.

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